IN THE CLAIMS:

1. (Currently Amended) Method for the treatment of materials, in particular waste materials and refuse, comprising:

supplying the material to be treated and a combustion supporter to an oxidation chamber or a combustion reactor, wherein the combustion supporter ~~comprises~~ consists essentially of oxygen and recycled gases; and

discharging gases produced during the oxidation or combustion of the material from the oxidation chamber or combustion reactor,

wherein the material to be treated and the products resulting from the oxidation or combustion are subjected to conditions of isothermy or quasi-isothermy at high or very high temperature, without substantial oxygen deficit, in any part of the chamber or reactor,

wherein the oxidation chamber or combustion reactor is operated at a pressure from greater than atmospheric pressure to 600 kPa,

wherein water is injected into the recycled gases to raise the concentration of water in the recycled gases to higher than 30% by volume, and

wherein at the mouth of the reactor the produced combustion fumes show a very low TOC and a negligible volatile ash content ~~a fraction of dust that is entrained out of the reactor with combustion fumes is reduced to a negligible value, and~~

~~wherein total organic carbon in combustion fumes at a mouth of the reactor is of the order of parts per million~~.

2. (Previously Presented) Method for the treatment of materials according to Claim 1, further comprising the supply of a combustion supporter comprising oxygen

mixed with gases resulting from the combustion, with water, or with a combination of gases and water, to bring about a high degree of opacification of the combustion supporter and to ensure almost instantaneous heating of the combustion supporter that is supplied into the reactor.

3. (Previously Presented) Method for the treatment of materials according to Claim 2, wherein the recycled gases resulting from combustion are supplied at minimized flow-rate and/or temperature so as to minimize the overall volume of gas in the reactor for a gas residence time in the reactor and to ensure the removal of a reaction heat from the reactor.

4. (Previously Presented) Method for the treatment of materials according to Claim 2, wherein the mixing of the oxygen with the recycled combustion gases takes place with a concentration of more than 10% by volume and preferably more than 60% by volume.

5. (Cancelled)

6. (Previously Presented) Method for the treatment of materials according to Claim 2, wherein the recycled gases which ensure the thermal balance of a plant that is operated continuously by removing the excess reaction heat owing to an appreciable enthalpy difference between the input and the output of the reactor are recycled at a minimum temperature that is compatible with normal cooling means.

7. (Previously Presented) Method for the treatment of materials according to Claim 2, wherein the recycled gases which ensure the thermal balance are constituted wholly or partially by steam.

Claims 8-9. (Cancelled)

10. (Previously Presented) Method for the treatment of materials according to Claim 1, wherein, in the reactor, the high rate of heating of the combustible material, in particular of its solid fraction, reduces to negligible value a fraction of dust that is entrained out of the reactor with the burnt gases.

11. (Previously Presented) Method for the treatment of materials according to Claim 1, wherein the fused slag is cooled and solidified into beads so as to ensure that toxic heavy metals contained in the incombustible slag are rendered completely inert.

12. (Previously Presented) Method for the treatment of materials according to Claim 1, further comprising a MIMO (multiple input/multiple output) control and optimization procedure which is focused on the parameters at the output of the reactor and in particular on measurement of gas composition at the output of the reactor.

13. (Previously Presented) Method for the treatment of materials according to Claim 12, wherein the measurements of the gas composition are implemented with characteristic response times of about 2 seconds.

14. (Currently Amended) An apparatus for the treatment of materials, in particular waste materials and refuse, comprising:

an oxidation chamber or a combustion reactor to which the material to be treated can be supplied comprising:

an input for a combustion supporter ~~comprising~~ consisting essentially of oxygen and recycled gases; and

an output for the gases produced during the oxidation or combustion of the above-mentioned material inside the chamber or reactor, wherein the oxidation

chamber or combustion reactor is substantially isothermic or quasi-isothermic in use at high or very high temperature, and without substantial oxygen deficit, in all of its parts,

wherein the oxidation chamber or combustion reactor is operated at a pressure from greater than atmospheric pressure to 600 kPa,

wherein water is injected into the recycled gases to raise the concentration of water in the recycled gases to higher than 30% by volume,

wherein at the mouth of the reactor the produced combustion fumes show a very low TOC and a negligible volatile ash content ~~a fraction of dust that is entrained out of the reactor with combustion fumes is reduced to a negligible value, and~~

~~wherein total organic carbon in combustion fumes at a mouth of the reactor is of the order of parts per million~~.

15. (Previously Presented) An apparatus for the treatment of materials according to Claim 14, wherein the walls of the reactor comprise a ceramic lining material which participates in the isothermy or quasi-isothermy of the reactor.

16. (Previously Presented) An apparatus for the treatment of materials according to Claim 14, further comprising means for cooling the gases produced during combustion, means for withdrawing and recycling a portion of the said cooled gases being provided for mixing the oxygen at the input to the reactor and producing a combustion-supporting mixture which is opaque to infra-red.

17. (Previously Presented) An apparatus for the treatment of materials according to Claim 16, wherein the cooling means comprise means for recovering energy from a high enthalpy value of the gases output from the reactor.

18. (Previously Presented) An apparatus for the treatment of materials according to Claim 16, further comprising means for mixing a portion of the recycled gases with the gases output from the reactor prior to entry of the gases into the cooling means.

Claims 19-20. (Cancelled)

21. (Previously Presented) An apparatus for the treatment of materials according to Claim 14, further comprising a plurality of feeders for supplying different materials to the reactor, in particular, solid materials in pieces, granular materials, liquid or sludgy materials, and/or gaseous materials.

22. (Previously Presented) An apparatus for the treatment of materials according to Claim 21, further comprising at least one propulsion chamber for the pressurized and discontinuous supply of solid materials in pieces into the reactor, said propulsion chamber comprising a duct for the supply of gas under pressure, withdrawn from the output line.

23. (Canceled)

24. (Previously Presented) An apparatus for the treatment of materials according to Claim 14, wherein the reactor comprises a base portion communicating with and inclined towards a heated duct for collecting fluid slag.

25. (Previously Presented) An apparatus for the treatment of materials according to Claim 24, wherein the collecting duct communicates with a container for collecting the fluid slag which is cooled rapidly in a water bath with the formation of solid beads so as to form a dilute water slurry.

26. (Previously Presented) An apparatus for the treatment of materials according to Claim 24, wherein the collecting duct comprises heating means for keeping the slag fluid.

27. (Previously Presented) An apparatus for the treatment of materials according to Claim 14, further comprising sensor means for measuring output parameters of the reactor, a control and management system receiving the signals of the sensor means in order substantially to improve the number of effective predictions for intervention in the operating conditions of the plant and to control fluctuations due to the non-homogeneity of the materials that are supplied into the reactor.

28. (Previously Presented) An apparatus for the treatment of materials operating in accordance with the method according to Claim 1.

29. (Previously Presented) Method for the treatment of materials according to Claim 6, wherein the minimum temperature is above the dew point of the recycled gases.

30. (New) Method for the treatment of materials according to Claim 1, wherein oxygen is substituted with technical oxygen.

31. (New) Method for the treatment of materials according to Claim 1, wherein the solid fuel is introduced into the combustor reactor by using recycled gas under pressure withdrawn from the output line of the reactor.

32. (New) Method for the treatment of materials according to Claim 4, wherein the recycle gas is substituted with water.

33. (New) Method for the treatment of materials according to Claim 14, wherein oxygen is substituted with technical oxygen.